BRADDA HEAD FIRE
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A REPORT TO THE ISLE OF MAN GOVERNMENT DEPARTMENT AGRICULTURE, FISHERIES & FORESTRY

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INTRODUCTION

Following a large fire on the Bradda Head area of the Isle of Man a site visit and a report on the extent of a damage and necessity of restoration were completed by Penny Anderson Associates (PAA). A site visit by this author was made possible by the Isle of Man Government in order to gain further information on the severity of the fire and the areas subsequent regeneration.

This report can be divided into two parts. The first section gives a brief description of what was observed during the site visit while the second section goes on to describe the lessons to be learnt and to give recommendations based on the observed impacts and events surrounding the fire.

It may be useful, while reading this report, to have the Phase I habitat survey and map of the fire area available.

Views expressed are solely those of the author.

All photographs are by the author unless otherwise stated.

PRE-FIRE VEGETATION

The size of the fire meant that very few areas of heathland remain untouched. It is possible to get some idea of the pre-fire vegetation from the Phase I Habitat Survey Maps. For the purposes of this report the area has been divided in two with the dividing line as the narrow gap where the fire passes between cliffs on one side and grassy fields on the other (see page 10). The southern area (Bradda Head) seems to have been characterised by a dominance of *Ulex gallii* together with *Calluna vulgaris*, *Erica cinerea* and *Ulex europaeus*. There were also extensive beds of *Pteridium aquilinum*. The northern area (the headlands around Fleshwich Bay) contained a much greater amount of *Calluna* and *Erica* with scattered areas of *Ulex* and *Pteridium*. This is evidenced from the Phase I habitat maps and also from the large areas of unburnt layered *Calluna* stems that were observed

The site is moderately-lightly grazed by rabbits and local knowledge suggests that it was last burnt some 50 years ago.

Unburnt heathland in the southern area of the Bradda Head fire, looking north-east. Vegetation is dominated by *Ulex galii* with small patches of *Calluna vulgaris*, *Erica cinerea* and occasional *Ulex europaeus* bushes. This small area was protected from the fire by a wide track.

DESCRIPTION OF FIRE IMPACTS

Damage to the Soil Substrate

PAA identified three levels of damage in their report and in general I would agree with that though I suspect the picture is slightly more complicated. I would identify four levels of damage to the substrate:

1. Little damage to ground surface with unburnt litter and no soil damage.
2. Most vegetative material consumed including litter layer leaving a bare exposed soil surface. Root mats are left behind.
3. Soil surface charred/partly burnt leaving behind a hard crusty surface reminiscent of clinker. This may be due to partly burnt organic matter or due to drying of the soil surface. The ground surface is stable.
4. Severe damage to the soil with consumption of all organic matter to a substantial depth. This has left behind a sticky ash/clay mixture with areas of red baked earth in places (indicative of very high temperatures and long fire

residence times). There are probably several varying degrees of damage within this category according to the depth of soil consumption. The ground surface is unstable.

Severity levels on the Bradda Head fire (from left to right):

1. Litter and stem material remain unburnt and soil surface is undamaged. Regeneration is generally good.
2. (Right hand-side of the picture). Most vegetation has been burnt away together with the litter layer. Soil surface is exposed but largely undamaged. Regeneration is variable. An area of fourth degree damage is found immediately to the left in this picture.
3. All vegetation and litter has been removed together with root mats. Soil surface has formed a hard impermeable crust due to a combination of scorching and drying out. Regeneration is variable.
4. All vegetation has been removed and organic matter in the soil has been burnt off leaving behind clayey, ashy deposits. Extensive areas of red ash deposits may be found, indicative of high temperatures. Regeneration is generally very poor.

- Areas of clearly different damage levels are often found immediately next to each other with little gradation from one level to another:

Left: Second level damage below, fourth level above.
Right: Fourth level damage in the bottom left, first level above.

- Regeneration is very variable across the damage levels.

- Fourth level damage appears to be generally more common in the southern area. Though large areas of the northern area show third level damage.

- The depth of soil damage is highly variable across areas of fourth level damage. It is interesting to note that even where soil was burnt to a considerable depth there still exists a brown-earth type soil below the damaged layers:

Note the red ash deposits in the right-hand soil section and exposed un-damaged brown-earth soil on the left. Despite their proximity depth of soil damage is very different in these two sections.

- At no place was it observed that the fire had burnt down to the mineral substrate.

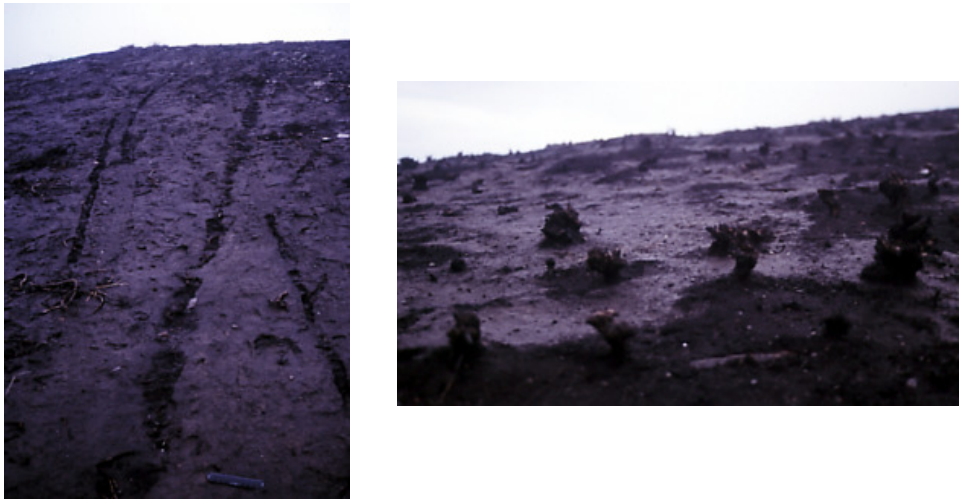
- Damage of level 3 and above is likely to have impacted on:
    1. The hydrology of the site: undamaged soil below dried/burnt/ashed deposits is very dry as these have effectively sealed the soil surface. This is likely to increase the possibility of erosion by rilling and sheet wash (more on this below).
    2. The regeneration of the site: through damage to or in some cases complete loss of the seed bank, below-ground rhizomes, bulbs etc.
    3. Soil invertebrate and michorizal communities, which may have an impact on future regeneration of the site.

- A normal management fire would not normally lead to damage greater than level 2.

Evidence of Erosion

One of the main concerns of PAA was that where areas were severely damaged the soil surface was likely to liable to erosion. There is extensive evidence that this has happened already:

1. There is evidence of rill formation especially below the cairn in the southern area.
2. There are large drifts of ash in hollows and against field boundaries. These are particularly evident in the northern area of the site.
3. Raised stem bases on severely burnt areas point to the fact up to 5cm of soil has already been lost in some places.



Evidence of erosion in the southern area of the Bradda Head fire.
Left: Rill formation below the cairn.
Right: Raised stem bases in areas of fourth degree damage suggest much erosion has already occurred.

Concern over the likely degree of erosion led PAA to suggest that if erosion was still evident in the summer following the fire then restoration, in particular the spreading of local grass seed, would be necessary to stabilise the soils.

On my visit large areas of the site appeared to have a relatively stable substrate, however this was after a period of heavy rain. Much of the worst of the erosion appears to have already occurred although sloping areas may continue to experience rill formation and sheet wash. Un-vegetated cliff faces remain particularly at risk. It will be important to note whether erosion continues on severely burnt areas when the site dries out.

REGENERATION OF THE SITE

Although four degrees of fire damage were previously described, this is complicated by the fact that the quality of regeneration does not always seem to follow on strictly from the nature of the damage to the substrate. In general areas with fourth level damage show little re-growth, while those areas of first level damage show extensive regeneration. There are however significant areas of second level damage with little re-growth, areas of third level damage with extensive regeneration and vice-versa.

A small seed-bank experiment suggested that in the severest areas of the fire few viable seeds remain.

Southern Area

The key feature of the southern part of the site is the patchy nature of the fire with juxtaposed areas of areas of severe fire impact and areas showing good regeneration particularly of *Ulex gallii* and *Ulex europaeus*. Some seedlings of *Eric cinerea* were found but there was very little *Calluna vulgaris* seen. The photographs on page 2 suggest however that these two species were relatively rare in this area to begin with.

While there are significant areas of fourth level damage these are never far away from areas showing good regeneration meaning that despite the loss of the seed-bank and lack of vegetative re-growth in these areas there is a seed source in close proximity. *Pteridium aquilinum* showed good regeneration across all levels of substrate damage, though in general damage to the soil appeared shallower in this habitat possibly due to the lower fuel loading. The possibility now exists for extensive bracken spread especially into those areas showing slower regeneration.

The opening up of the area by the fire has allowed the growth of species such as *Silene uniflora*, *Jasione montana* and *Sedum anglicum* which were probably largely absent from the dense stands of gorse and bracken.

The photographs below give an indication of the variation in regeneration found in this area.

Right to left from top left. 1: View from below the cairn to Milner's tower over an extensive area showing good regeneration. 2: View up to cairn over a severely burnt area with little regeneration. 3: Even in severely burnt areas some *Ulex* bushes show vegetative regeneration. 4: An area of good regeneration, note the presence of fire "hot spots" with fourth degree damage. 5: Bracken survives even on heavily burnt areas. 6: Bracken may spread rapidly into neighbouring severely burnt areas. 7: Species such as sea campion are able to take advantage of the removal of the *Ulex/Calluna* canopy. 8: Sheeps-bit alongside *Erica cinerea* seedlings.

Northern Area

In the northern area of the fire it appears that the burn-off was generally much more complete with the loss of most material down to but no including the soil. It was, however, hard to get a really good feel for the area after mist came down. Again the severity of the fire was patchy though I would hazard a guess that the majority of this area had suffered third or fourth level damage. Regeneration was relatively rare and no vegetative re-growth of *Calluna* or *Erica* was observed. This was not particularly surprising given the age of the heather and the severity of the fire. Some areas of dense *Calluna* seedlings were found. There were also some areas of good *Ulex gallii* regeneration. On the lower slopes around the plantation (itself scorched by the fire) re-growth of *Pteridium aquilinum* was good and this is likely to spread uphill into bare areas.

Interestingly there were some areas where the litter layer remained, together with many unburnt layered *Calluna* stems and interestingly these areas showed poorer regeneration than where this layer was removed. Possibly seeds in the litter layer had been killed by the passage of the fire whereas those buried in peat were better protected from raised temperatures.

The cliff faces around Fleshwick Bay are particularly important for *Scilla verna* and a brief investigation of the bottom of the cliffs in this area showed that despite third degree damage to the substrate this plant had survived and there was also re-growth of *Ulex gallii*, *Pteridium* and *Rubus fruticosus* as well as seedlings of *Eric cinerea.*

Left to right from top left. 1: Northern side of the headland at Fleshwick bay showing extensive bracken regeneration. 2: The view east on top of the headland, there is little regeneration. 3: The view west on top of the headland, again there is little regeneration. 4. Dense growth of *Calluna* seedlings, such regeneration is rare in the northern area. 5: *Umbilicus rupestris* in a crack in a rocky outcrop. 6: Scorch damage to the plantation. 7: Spring squill and *Erica cinerea* seedlings at Fleshwick bay.

RESTORATION/MONITORING EFFORTS TO DATE

- PAA were contracted to provide and have a completed a costed report on the options for the restoration of the site.
- The rough total area burnt has been mapped.
- An informal photographic monitoring programme has been undertaken.
- A small area around the cairn was covered with heather mulch in an effort to prevent further erosion and provide a seed source for regeneration. This seems to have had little impact for several reasons: material has been blown off the site and collected along adjacent field boundaries. The close proximity of the mulched area to these boundaries means it was unlikely to provide any additional benefit in terms of erosion prevention anyway. The number of heather seedlings noted around the mulched area were in single figures. This is possibly attributable to the depth the mulch had collected to and the alleopathic properties of material leached out of the mulch itself.

IMPLICATIONS AND RECOMMENDATIONS

The fire on Bradda Head is without a doubt the most severe that this author has ever seen. In terms of the impact on the site the important thing to keep in mind is that the severity of the fires impact over the site was very varied and it has left behind a mosaic of areas with different levels of impact. In general the northern area of the site seems to have been worst affected. PAA have compiled a report on the impacts of the fire with which I generally agree, though the situation does seem to be much more complex than their three levels of impact. They also outlined recommendations for the process of restoration. Before deciding whether or not restoration goes ahead consideration needs to be given to a number of areas which the fire has impacted on.

1. Impacts on the conservation value and ecology of the site.
2. Impacts on the amenity/landscape value of the site.
3. Impacts on the research/knowledge value of the site.
4. Lessons learnt from the fire.

Consideration also needs to be given to the high cost of restoration as proposed by PAA and the possibilities for such funds to be allocated for conservation efforts elsewhere on the island.

Conservation Impacts

The area of coastal heathland on the Isle of Man and in the UK as a whole is limited and the site prior to the fire had a high conservation value both due to its botanical content and as an important breeding ground for chough (*Pyrrhocorax pyrrhocorax*). This is evidenced by the fact that prior to the fire its designation as the islands second nature reserve was pending.

The immediate impact of the fire has been to remove some of the nature conservation value of the site. In the southern part of the site there are however significant areas of good regeneration with islands (some fairly large) of fourth level damage amongst them. Regeneration is good enough in this area to warrant restoration largely unnecessary, though this does not necessarily mean it will be rapid everywhere. Areas which have experienced fourth degree damage may remain un-vegetated for extended periods. Erosion in these areas may continue to be a problem but material is likely to largely end up in adjacent re-vegetated patches as opposed to being lost to the site altogether (this problem may be of more concern on exposed cliff slopes). I would

envisage the development of a patchwork of areas of *Ulex/Erica/Calluna* heathland with interspersed un-vegetated areas which will gradually grass over (possibly providing a habitat for species such as *Silene uniflora*, *Jasione montana* and *Sedum anglicum*). Heathland species will gradually invade these areas from the edges.
Some parts of the southern area appear to have been subject to fairly heavy grazing by rabbits. This should not be of major concern as they have mainly targeted grass species and young re-growth of *Ulex*. Such grazing may in fact help speed up the re-vegetation of the site by encouraging lateral growth of shrub plants.

It was more difficult to gauge the overall nature of the northern part of the site as it was so misty. Regeneration appears to be, in general, very poor. There are several pockets of good regeneration which will provide seed sources for the rest of the site but otherwise it would seem that this area may remain fairly barren for some time. Regeneration would undoubtedly be much quicker if the area were re-seeded otherwise the site may become largely dominated by grasses, herbs and invasive "weed" species with reversion to heathland taking a considerable amount of time.
There do not seem to be the extensive areas of ashy deposits found in the southern area of the site and in general the soil surface is fairly consolidated. In places it has been scorched or dried to form a hard crust. Further erosion from this area is therefore possibly not as likely. Though further disturbance, from walkers for example, could break up the surface crust and enable rapid erosion.

The main concern for the site as a whole has to be the likelihood of rapid bracken spread into areas with poor regeneration which may prevent the re-growth of heathland vegetation.

Amenity Impacts
The area of Bradda is important for recreation. A footpath crosses the area from Fleshwick Bay to Port Erin. Consideration should be given as to whether this route is desirable in the medium-term as it crosses areas which will be sensitive to further disturbance. The path also passes through a narrow gap between fields and cliffs (the dividing zone between the north and southern areas): an area which has experienced fourth degree damage. The loose soil and slippery surface may be a safety issue.
Recreational activity is mostly focused in the southern part of the site and if restoration work is not undertaken in this area it may be necessary to explain the reasoning for this decision to the local population some of whom have expressed dismay at the impacts of the fire and may find the un-vegetated areas displeasing. Seeding such areas with grasses to green them over might be a consideration.

Research/Knowledge Impacts
There is currently no formal monitoring programme examining the impacts of the fire and its regeneration. A carefully designed monitoring programme would provide an excellent opportunity for learning about the impact of fire on these sorts of habitat and the ecological impacts of severe fires. It would also allow an assessment of the cost-effectiveness of any restoration work undertaken to be measured.
It would certainly be interesting to follow the "natural" process of regeneration which takes place on the site.
Also of interest are the archaeological features which have been uncovered including ridge and furrow field systems, old field boundaries, stone structures and the remains of the Victorian era promenade and golf-course.

Several archaeological features have been uncovered by the fire including this structure on the headland above Fleshwick Bay.

LESSONS LEARNT

The extent and certainly the severity of the fire can be attributed largely to the lack of any form of management on this area of heathland. Fires in this sort of habitat do not need to be damaging and carefully planned burning can be used to create a patchwork of habitats, improve biodiversity and reduce fire risk. However with a lack of any regular management activity and a period of fifty years since the last fire fuel loadings had built up to high levels with large amounts of dead material and litter creating, in essence, a time-bomb situation: **the fire was waiting to happen**. The high fuel loading allowed for increased fire severity, intensity and higher rates of spread making its eventual control much more difficult. Though the area was crossed by several tracks and paths none of these served as an effective fire break.

It is also clear that at several points there were opportunities to halt the spread of the fire and these were not taken. Lack of training for members of the fire brigade may have been partly to blame. Some of their fire control actions appear somewhat questionable, but it is unfair to pass any real judgement without more information. It is evident that the extreme fire conditions (dry, hot/sunny and windy) may have made control very difficult. There is evidence of extensive "spotting" (fires being lit by embers ahead of the main fire front). A change in wind direction which carried the fire into the northern area was also sheer bad luck though effective firebreaks in the narrow neck between the two areas could have prevented this.

The fact that the fire began from a garden bonfire in an area with gorse hedges also suggests a lack of understanding of the risk on the part of house-holders living adjacent to heathland areas.

Left: The starting point of the fire was behind the houses on the right. Originally small in area the fire seems to have spread along gorse hedges onto the open heathland of Bradda Head. This could have been prevented if the hedge fires were extinguished and observation posts had been set up to check for "spotting" onto areas of open heath.

Right: The narrow gap through which the fire passed into the northern area of the site. Strategically placed fire breaks and observation posts could have prevented this. Instead considerable time was spent bulldozing firebreaks between the heathland and an area of wet grassland to the south.

Photographs by Dru Leoidson.

Several areas of coastal heathland exist on the Island: **at some point these will burn** and immediate consideration should be given to how the damaging levels of severity and size of fire that occurred on Bradda can be avoided. Any funding made available as a result of this incident would be best employed to ensure effective management of other heathland areas.

With all this in mind it is possible to make a number of recommendations:

For the Bradda Head Fire

- The extent of the fire and the areas suffering different levels of severity need to be accurately mapped in order to properly understand the fires impact and identify areas which may benefit from restoration. This could be done rapidly by a fieldworker with a hand-held GPS or alternatively aerial photography could be attempted.
- Bracken spread is likely to be a problem and the current extent should be at least roughly mapped so this can be monitored and remediative action taken if necessary.
- Monitoring of further erosion from severely burnt areas would be useful in order to decide if grass seed spreading was worthwhile.
- Fixed point photography if it is to be undertaken should be formalised with properly fixed locations (it's as simple as a post in the ground and a compass).
- Further monitoring would provide interesting and useful information and a well designed monitoring strategy would prove valuable. This could include: monitoring the extent and distribution of damage to soils, monitoring regeneration of plant communities, monitoring seed rain into severely damaged areas and examining the impact of the fire on habitat use, by chough for example.
- Based on the above a decision can be made as to whether designation of the area should go ahead.
- Record and survey archaeological features uncovered by the fire.
- Consider fencing the cliff-side edge of the path between the southern and northern areas of the fire if not closing this stretch of path.
- Interpretative boards along the paths through the site might prove useful in explaining to the public what happened, what's being done and how to prevent future fires.
- The high cost (both monetary and in terms of labour) of the restoration programme as envisaged by PAA makes it largely unfeasible. If funds are available they would be best spent ensuring better management of remaining heathland areas and on surveying and monitoring the impact of the fire.
- Restoration work may be a valuable exercise in a number of small accessible areas where the appearance of the site may be of concern to the public and access may encourage erosion or to provide islands from which heathland vegetation can spread into un-restored areas.

For Heathland Habitats on the Island as a Whole

- Assess the current status of heathland management practice on the island.
- Fuel loading/habitat surveying and mapping of existing fire breaks on heathland areas will allow an assessment of fire risk to be made.

- Existing paths through heathland areas could be widened by cutting and the mulch spread on areas of Bradda Head. This will aid restoration of the heathland and create fire breaks.
- Review the possibility for breaking up the dense homogenous stands of *Calluna/Ulex* on unmanaged heathland: fire and cutting. Such activity could become the responsibility of landowners if a site were to be designated.
- Review the ability of the fire brigade to deal with such events: do they have the skills, training and equipment to effectively control fires on the open hill?
- Ensure an accurate database of the extent of this habitat type exists for the Island.
- The Heath Burning Act (1939) governs such activity and possibly requires review. For example while individuals cannot be held responsible for accidental fires the new Scottish Nature Conservation Bill contains a clause on "reckless endangerment."
- Consider whether bonfires in private gardens bordering areas of moorland should be restricted during periods of high fire risk.
- A number of fire danger rating systems exist which could be used to assess fire risk and inform the public during periods of high risk.

Policy makers, land-owners, local authorities and the general public need to understand that the lack of any management on sites such as Bradda means that another wildfire is waiting to happen.